**Photopolymers for cheap and efficient photovoltaics: a research work of Politecnico published by Science**

A hybrid material, both organic and inorganic, able to absorb the entire solar spectrum and to transport the electric charge with high efficiency: perovskite represents the last frontier in the field of next-generation photovoltaics, till now little studied in Italy, but rapidly with truly remarkable results from the scientific point of view. *Science*, one of the most prestigious international journals weekly produced by the American Association for the Advancement of Science, has published today an experimental research work conducted by Politecnico di Torino with the Ecole Polytechnique Federale de Lausanne (EPFL), Politecnico di Milano and Italian Institute of Technology, entitled "Improving efficiency and stability of perovskite solar cells with photocurable fluoropolymers".
The research work, led by Politecnico di Torino, has been carried out by **Federico Bella** from Applied Science and Technology Department (DISAT) under the supervision of Prof. **Claudio Gerbaldi** (coordinator of the *Group for Applied Materials and Electrochemistry - GAME Lab*, DISAT) and with the support of Prof. **Guido Saracco**, coordinator of the *Center for Sustainable Futures @PoliTO* within the Italian Institute of Technology.

This scientific study is focused on perovskite solar cells, based on a new material recently proposed by Professor Michael Grätzel (EPFL); the first research results are so promising that it is assumed that large-scale application of this material will be concrete by 2020. In addition to the unique properties of perovskite, in fact, photovoltaic cells based on this technology can be produced by a simple and fast technology, with a sure industrial scalability. The most important universities and research centers worldwide are therefore investing a large number of human and financial resources on the development of these perovskite solar cells, and this has led to a dramatic increase in the sunlight conversion efficiencies of this technology, more than quintupled (4-22%) in the last six years.

Obviously, any new technology brings with it a number of limitations to be overcome before they can be marketed. In this case, perovskite solar cells are subject to considerable losses in efficiency when exposed to ultraviolet light (present at 5% in the solar spectrum) and atmospheric moisture. Rain and sun therefore cause the degradation and the complete loss of functionality in short time, at best after a few days.

The research published by Science focuses on this issue, also considering that one of the main applications of these devices would be the buildings integration. The research team from Politecnico di Torino, together with Gianmarco Griffini and Stefano Turri at Politecnico di Milano, has conceived and proposed a coating made of an innovative polymeric material able to effectively counteract the aging of perovskite solar cells. Researchers have synthesized a fluorinated coating with micrometric thickness, imperceptible on a device slightly larger than a stamp, and able to act as an effective barrier against moisture and ensure self-cleaning characteristics to the solar panels when exposed to rain, smog, dust, etc..

The coating has been produced through photopolymerization, a very fast light-curing technique, economical and with low environmental impact (it is commonly used for dental fillings and in nails-care). To counteract the aging of materials induced by ultraviolet light, the polymeric coating has also been doped with luminescent molecules capable of converting the ultraviolet light present in solar radiation in non-harmful light for the solar cell.

The solar cells have been assembled, characterized and tested under different accelerated aging conditions for over a year in different laboratories, including those of the Ecole Polytechnique Federale de Lausanne where our team worked Juan-Pablo Correa-Baena, Michael Grätzel and Anders Hagfeldt, luminaries in the field of next-generation photovoltaics.
With efficiencies close to 19% and with exceptional stability when subjected to a series of aging tests even under extreme conditions, the innovative perovskite solar cells proposed in Science confirm the significant prospects of this new solar energy conversion technology, which can effectively compete with classic silicon panels in building, but also be coupled to the same silicon in high performance tandem devices.